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## (54) Data acquisition and processing system

(57) A system suitable for use with data relating to medical patients comprises a primary data storage group 10, a secondary data storage group 12 and a third-level data storage group 14. Primary group 10 is operable to store data on patients; secondary group 12 comprises units each operable to receive patient data from, and to transmit data changes to, the primary group, and third-level group 14 comprises hand held units each able to receive and display patient data from a unit of the secondary group, to amend the data and to transmit amendments to the secondary group unit. Each secondary group unit may comprise a personal computer or computer terminal and preferably has a printer for printing barcoded labels. The hand-held units (Figs. 3, 3A, 3B) of the third-level group 14 preferably each have a barcode reader (30) and a touch screen (26) at which Indicia are displayed for the user to select data to be received, and for data input.

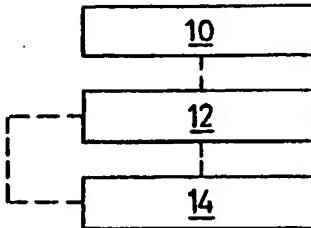


Fig. 1

GB 2 279 784 A

1/2

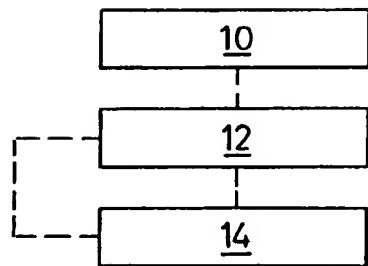


Fig. 1

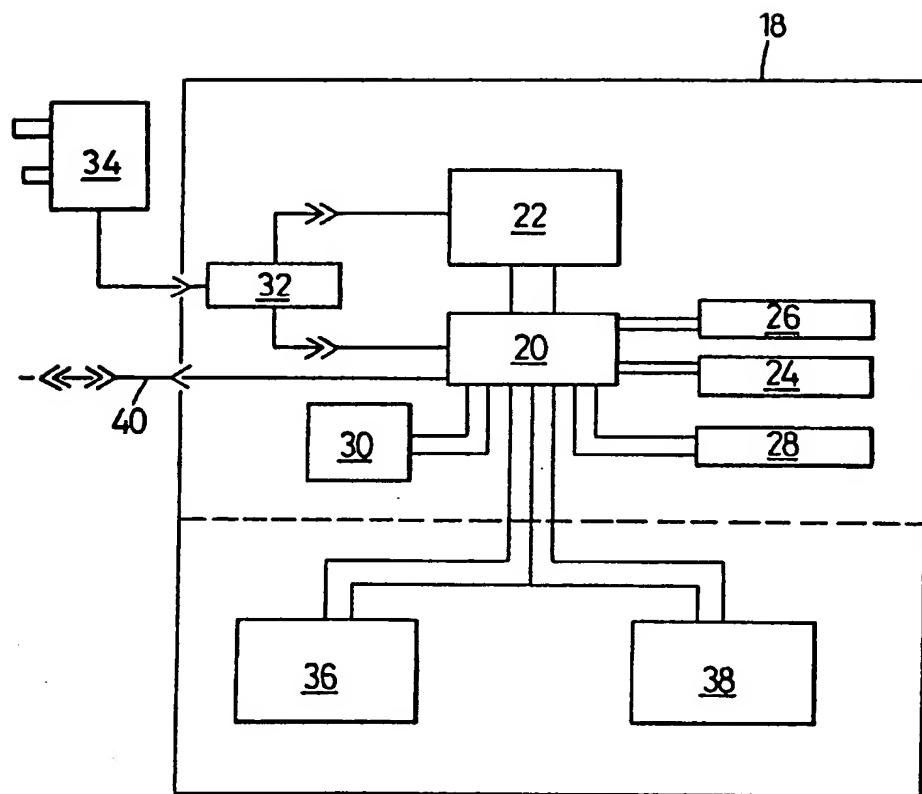


Fig. 2

2/2

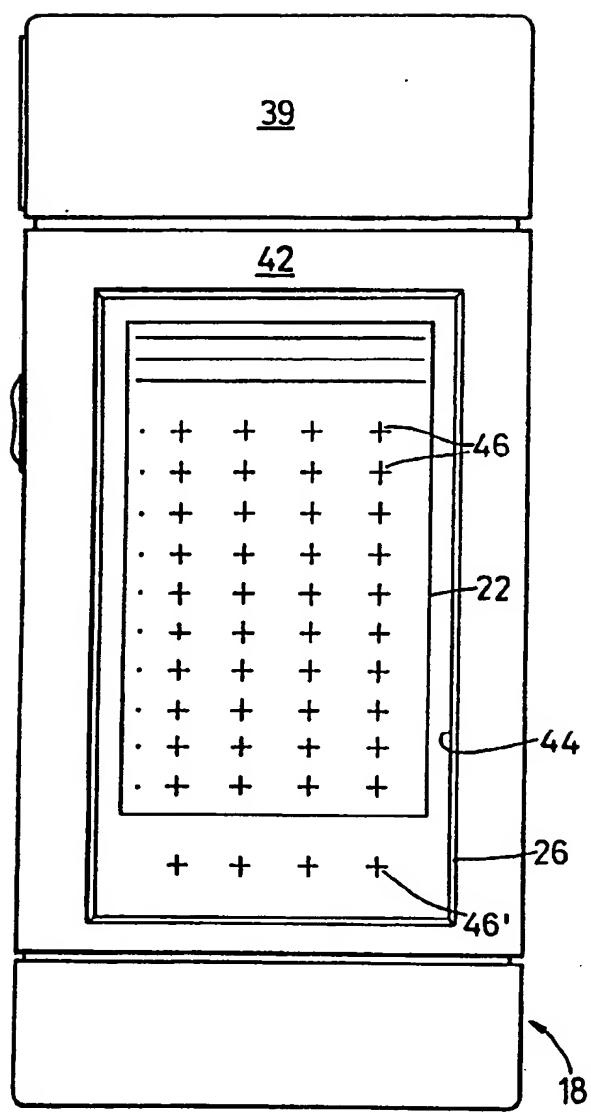


Fig. 3A

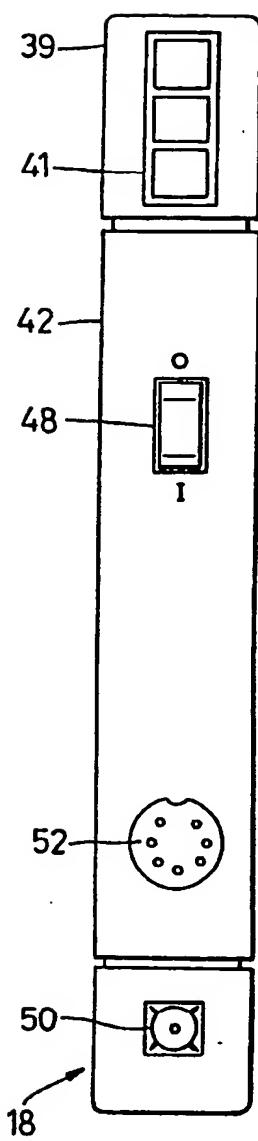


Fig. 3B

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1

## DATA ACQUISITION AND PROCESSING SYSTEM

The present invention relates to a data acquisition and processing system adapted particularly, but not exclusively, for use with data relating to medical patients, supply of articles therefor, and treatment thereof.

The secure and reliable handling and acquisition of data is of the utmost importance in a medical environment. For example, if blood is to be obtained for a patient, the data related to the patient's identity and the type of blood required must be accessed to order the blood. Then at the point of treatment that data must be accessed once again to ensure that the correct blood has been delivered for the patient. The importance of correct accessing and comparison of this data cannot be overstressed since administration of the wrong type of blood could have serious or even fatal consequences for the patient.

There are many similar occasions in patient care where access, capture and comparison of data, where made at the point at which treatment is administered to the patient, improves the efficacy and security of the treatment.

It is known to provide a computer terminal at a treatment location whereby a person administering treatment to a patient may access the, and add to, records of that patient. However, such known systems have disadvantages. The terminal is, inevitably, located some distance from the patient, thus causing some inconvenience in use. Data identifying the patient must be entered manually into the terminal with the risk that the patient is mis-identified, this being

especially likely where the patient has a common surname or where multi-character unique identity codes are used. Then, once data is obtained from the terminal on, for example, a patient's blood type, it must be transposed to whatever ordering system exists to obtain the required supply of blood, with the consequent risk of an error occurring in the transposition.

The present invention aims to provide a system whereby patient data may be accessed and/or created conveniently and be used reliably by a person administering medical treatment or nursing care whilst with a patient.

The present invention provides, in a first of its aspects, a data processing and acquisition system comprising a primary data storage group, operable to store data on a plurality of medical patients, a secondary data storage group comprising a plurality of units, each operable to receive from the primary data storage group data on a plurality of patients, and to transmit to the primary data storage group changes made to that data while it is stored in the unit, and a third-level data storage group comprising a plurality of hand held units, each operative to receive data on a plurality of patients from a unit of the secondary data storage group, to display the data to a user and, in response to actions of the user, to amend the data and transmit those amendments to the said unit of the secondary data storage group.

The provision of three levels of data storage and access to the data available on medical patients enhances the flexibility and convenience with which

members of medical staff may access the data, thus making use of the system attractive to the users.

Preferably, each unit of the secondary data storage group comprises a personal computer or a computer terminal, and more preferably further comprises a printer. The provision of a printer may allow identification labels for a patient to be printed, at least one of the labels most preferably including an identifying barcode.

Each hand held unit of the third level data storage group is preferably provided with a barcode reader. When used with the most preferred arrangement of the secondary data storage group described above, the barcode reader is preferably operative to read a barcoded identity of the doctor, nurse or treatment generated by the printer.

Each hand held unit may further be provided with a touch screen by means of which the user may input data and control the operation of the unit. Preferably, the touch screen is transparent and the unit is further provided with a display device mounted such that it is visible through the touch screen on which indicia may be displayed to indicate to the user the function of the touch-sensitive points within the touch screen.

Each hand held unit may comprise at least one module in which is carried electronic memory accessible by the unit. Preferably, the module is readily detachable from the unit and connectable to other apparatus, for example a unit of the second data storage group, for reading data from and writing data to its memory. Such a module provides a quick and convenient means by which data may be transferred to

and from the hand held unit. More preferably, each hand held unit comprises two memory modules, a first being a system memory module in which is stored a program and/or data for controlling the operation of the unit and the second being a data exchange module in which patient data may be stored. The unit may further comprise an electronic communication link over which data may be received and transmitted by the unit.

In a second of its aspects, the invention provides a device for input and output of data from data processing and/or storage apparatus comprising a touch screen, the touch screen being transparent or having one or more transparent regions and having a plurality of touch-sensitive points, a display device visible through the touch screen or the transparent regions thereof, the display device being operative to display to a user information regarding the function of individual touch-sensitive points of the touch screen wherein in a first mode, individual characters are displayed adjacent a respective touch-sensitive point, actuation of a touch-sensitive point by a user representing input of the corresponding single character and in a second mode at least one image relating to a menu option or an operation to be performed is displayed adjacent a respective touch-sensitive point, actuation of a touch-sensitive point by a user representing selection of the corresponding option or operation.

Such a device may be used in the second mode of its display device for input into a menu-driven system and, when required, may switch to its first mode to allow a user to input textual or other alphanumeric data, so avoiding the need for separate input means for menu selection and text or alphanumeric input.

In a third of its aspects the invention provides a method of operating a display of information in which a device according to the second aspect of the invention is used, the user of the device operating the display device thereof by actuating a respective touch-sensitive point of the touch screen to input a desired requirement from information displayed at the touch screen when the display device is in the first mode, and actuating a respective touch-sensitive point of the touch screen to select a menu option or operation displayed at the touch screen when the display device is in the second mode.

In a fourth aspect, the invention provides a hand held unit for acquisition, processing and onward transmission of data comprising a microprocessor, a memory, and input and output devices for receiving data into and displaying data in the memory wherein at least part of the memory is in a data exchange module which is readily removable from the unit and which is connectable to remote apparatus operable to read and amend its contents.

Thus data stored in the data storage module by the remote apparatus is accessible by the hand held unit on connection of the data exchange module thereto. Similarly, any change to the data made by the hand held unit may be read from the memory by the remote apparatus.

The unit may further comprise a system memory module which is readily removable from the device in which a program and/or data for controlling the device is stored. In this way, the operation of the device may conveniently be altered by substituting the system

memory module for another or by changing its contents as may conveniently be carried out by remote apparatus.

Preferably, the input and output devices include a device according to the second aspect of the invention, and may further include a barcode reader and an electronic data link.

An embodiment of the invention will now be described in detail by way of example with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of the organisation of the system as a whole;

Figure 2 is a block diagram of a hand-held data collection unit for use with the invention; and

Figure 3 is an external view of the data collection unit represented in Figure 2.

With reference to Figure 1, a system according to the invention has three main groups of components: a primary data storage group 10; a secondary data storage group 12; and a third-level data storage group 14.

The primary data storage group 10 provides a permanent store for data on all patients under the care of the operator of the system, for example a health authority. The primary data storage group 10 is largely conventional and may typically comprise a mainframe computer or a networked system of smaller computers.

The secondary data storage group 12 provides access to the primary data storage group 10 close to

the point of treatment. For example, it may comprise a plurality of units each comprising a personal computer and, optionally, a printer, one being provided typically in each hospital department or ward. The individual units which make up the secondary data storage group 12 may be in permanent communication with the primary data storage group (for example by a direct digital line) or may communicate as and when required, for example over the public switched telephone network.

Each unit of the secondary data storage group 12 is capable of storing data on a plurality of patients. For example, if a unit is installed in a ward, data on all patients in that ward will be held on the unit. Each unit also has the capability of initiating transfer of data between itself and the primary data storage group 10. For example, when a patient is admitted to the ward, the unit requests data on that patient from the primary data storage group 10. If data on that patient alters, for example as a result of observations or treatment during the patient's stay in the ward, the unit can initiate the transfer of the amended data to the primary data storage group.

Each unit in the secondary data storage group 12 is also responsible for processing certain requests. In particular, if a request is made for delivery of drugs to a patient then this request will be relayed to the primary data storage group 10, which will then forward the request to the relevant department. Similarly, if a treatment is required for a patient (such as an operation), a request will be relayed to the primary data storage group 10 which will forward it to the department concerned. When the necessary arrangements have been made (such as the time and place

of the treatment) these will be passed by the primary data storage group 10 to the relevant unit for action.

Once the treatment has been completed or the drugs administered, this information will be passed to the relevant unit of the secondary data storage group 12, and then forwarded to the primary data storage group 10 such that the patient's records may be updated appropriately.

The third level data storage group 14 provides a very convenient means by which data may be communicated to the secondary data storage group 12; it comprises a plurality of hand-held units 18, as illustrated in Figures 2 and 3. It is envisaged that each person responsible for caring for a patient will be provided with such a hand-held unit to be carried with them throughout their working day. Alternatively such a hand-held unit may be placed at a convenient position within a location where any one of a number of persons responsible for patient care may take up and use the unit for a data collection episode and then return it to that position at the completion of the episode.

With reference to Figure 2, each hand-held unit 18 is based around a microprocessor 20. In this embodiment, the microprocessor is a 86C91 (Z8) unit, the use of which is convenient because it contains, as well as conventional registers and memory buses, 16 I/O lines, 256 bytes of internal RAM, a serial port, and a dual counter/timer, so allowing a particularly compact and simple structure to be achieved.

The unit 18 is provided with various input/output devices: for output, a 300 x 200 dot LCD display unit with controller 22 and a sound output device 24, and

for input, a transparent touch screen 26, a date/time clock 28, and a barcode scanner 30. The unit is powered by a nickel cadmium battery pack 32 and, optionally, by an external power supply 34 which also serves to recharge the battery pack 32. Each of these units will be described in more detail below.

The unit 18 has two memory modules; a system memory module 36 and a data exchange module 38, each comprising up to 64 kbytes of CMOS static RAM with battery back-up. The two memory modules 36,38 are each removable from the unit 18 to allow data to be exchanged between the unit 18 and the secondary data storage group 12.

A serial link 40 is provided by means of which the unit 18 may be connected to a modem or other communication device and over which data may be transferred between the unit 18 and the secondary data storage group 12.

The unit 18 is contained in a unitary case as illustrated in Figures 3A and 3B. The case is generally rectangular in plan having a large top and bottom panel and smaller side panels, the case being dimensioned such that it may be easily held in one hand.

In an upper portion 39 of the case there is mounted the barcode scanner 30. A transparent window 41 is provided in a side wall of the upper portion 39 of the case through which the barcode scanner 30 may read a barcode.

The case has a middle portion 42, through a front panel of which there is provided a rectangular aperture 44. The touch screen 26 is mounted within the

case such that access to its touch-sensitive surface may be gained through the aperture 44. In this embodiment, the touch screen 26 has forty touch points 46 set out within the periphery of the LCD display unit 22. Additionally, there are four further touch points 46' arranged in a row spaced from the other touch points 46 outside the periphery of the LCD display unit 22.

The LCD display unit 22 is mounted in the case inwardly of the touch screen 26 such that it is visible through the touch screen 26. In this way, indications may be displayed on the LCD display unit 22 to signify the function of the various touch points 46 within the periphery of the LCD display unit 22. The four touch points 46' positioned outside the periphery of the LCD display unit are to initiate controls in the program operating the unit.

Also mounted in the case and accessible through apertures in a side wall of the case is an on-off switch 48, a connector 50 to connection with the external power supply 34 and a connector 52 to connection with the serial link 40.

In use, the system memory module 36 is loaded with control software to be executed by the microprocessor 20, together with data for configuring the options to be available to a user. The loading may be carried out through connection of the module to a conventional computer, suitable programmed in a manner well known to those skilled in the art.

The software is operative (1) to receive data from the secondary data storage group and store this in the memory of the data exchange module 38; (2) to read a

barcode and establish whether it identifies a patient whose data has been stored in the data exchange module 38; (3) once a patient has been identified, present the user with a range of options which allows the user to obtain further data on the patient or to order supplies for that patient.

Examples of the procedure for one use of the system will now be described.

Admission of a patient:

On admission of a patient to a ward, details of that patient are entered into a unit of the secondary data storage group 12, and the data on that patient is requested from the primary data storage group 10.

Once the unit receives the data it displays on the screen of the computer details of that patient and requests that the operator confirm that the details are correct. Once this confirmation is given, the unit sends a message to the primary data storage group 10 to confirm that the patient has been admitted.

Following this, the unit prints a set of identity labels for use at the patient's bedside, on their files, and so forth. A label is also printed for use in an identity wristband.

At least the label for the wristband, and more preferably all of the labels, are printed with a barcode which is readable by the barcode reader 30 hand held unit 18 so that details of the patient may be accessed without manual input of identifying data by a user.

Following admission of a patient, a staff member can request that data on the patient is transferred from the local unit of the secondary data storage group 12 to their hand held unit 18.

Blood Product Requisition:

At the patient's bedside the hand held unit is used to scan the patient's barcoded identity band. Once the patient has been identified the unit will display on its LCD display unit 22 an initial menu of descriptions of a number of options appropriate to that patient each being adjacent a respective touch point 46.

The operator then touches the touch point 46 adjacent the description of the option which relates to the requisition of blood. Following this, the user will be presented with a further menu of options which allows the requirements to be further specified, such as where there is an infection risk; where this is not available from the patient's records, identity of the blood group; number of units required and so forth. Each time a selection is made, if further specification is required a new menu will be displayed.

In all menus, except the initial one, a touch of one of the touch points 46' outside the periphery of the LCD display unit 22 will initiate progress backwards through the hierarchy of displays to the previously active menu, and in all menus, except the last one, a touch of another of those touch points 46' will initiate progress forwards through the hierarchy of displays to the next active menu.

On completion of the selection, the hand-held unit 18 is carried to the nearest unit of the secondary

data storage group 12 and connected thereto by means of the serial link 40. Once connected, it transfers to the unit of the secondary data storage group 12 details of the requisition order made by the operator. An order is then dispatched by the system automatically to the blood bank, either as an electronic message to the blood bank computer or as a paper order printed by the printer of the unit of the second data storage group 12.

On receipt of the blood at the patient's bedside, the person responsible for its administration first scans the barcode on the patient's identity wristband and then uses the menus as described above to select the operation of administration of blood. The unit 18 will then display on the LCD display unit 22 a message requesting the user to scan the barcode on the pack of blood. If the numbers scanned from the blood and from the patient do not match then the unit 18 will display a warning message and will operate a warning noise through its sound output device 24. If the numbers match then a confirming message is displayed.

Following administration of the blood, the hand held unit 18 is once again connected to a unit of the secondary data processing group 12 by the serial link 40 in order that the fact that the blood has been administered and details of that blood may be recorded.

Should an option be selected which requires input of alphanumeric data (for instance, a patient's name or address) there will be displayed on the LCD display unit 22 single characters each at a position corresponding to a respective one of the touch points 46. For example, all letters of the alphabet may be displayed in this way, as could the numbers 0 to 9. Thus, by touching the appropriate points 46 the

**touch screen 26 may be used in a manner similar to a  
standard input keypad.**

CLAIMS

1. A data processing and acquisition system comprising a primary data storage group, operable to store data on a plurality of medical patients, a secondary data storage group comprising a plurality of units, each operable to receive from the primary data storage group data on a plurality of patients and to transmit to the primary data storage group changes made to that data while it is stored in the unit, and a third-level data storage group comprising a plurality of hand held units, each operative to receive data on a plurality of patients from a unit of the secondary data storage group, to display the data to a user and, and in response to actions of the user, to amend the data and transmit those amendments to the said unit of the secondary data storage group.
2. A system according to Claim 1 wherein each unit of the secondary data storage group comprises a personal computer.
3. A system according to Claim 1 wherein each unit of the secondary data storage group comprises a computer terminal.
4. A system according to Claim 2 or Claim 3 wherein each unit of the secondary data storage group further comprises a printer.
5. A system according to Claim 4 wherein the printer allows identification labels to be printed for a patient, at least one of said labels including an identifying barcode.

6. A system according to any preceding claim wherein the third-level data storage group is provided with a barcode reader.
7. A system according to Claim 6 as dependant from Claim 5 wherein the barcode reader is operative to read a barcoded identity of a doctor, nurse or treatment generated by the printer on at least one of said labels.
8. A system according to any preceding claim wherein each hand held unit of the third-level data storage group is provided with a touch screen by means of which the user may input data and control the operation of the unit.
9. A system according to Claim 8 wherein the touch screen of each hand held unit is transparent and the unit has a display device visible through the touch screen on which indicia may be displayed to indicate to the user the function of touch-sensitive points within the touch screen.
10. A system according to Claim 8 or Claim 9 wherein each hand held unit comprises at least one module in which there is an electric memory accessible by the unit.
11. A system according to Claim 10 wherein the module is detachable from the unit and connectable to other apparatus for reading data from and writing data to its memory.
12. A system according to Claim 10 or Claim 11 wherein each hand held unit comprises two said memory modules, being a system memory module in which is stored a

program and/or data for controlling the operation of the unit and a data exchange module in which patient data may be stored.

13. A system according to Claim 12 wherein each hand held unit comprises an electronic communication link over which data may be received and transmitted by the unit.

14. A device for input and output of data from data processing and/or storage apparatus, comprising a touch screen, the touch screen being transparent or having one or more transparent regions and having a plurality of touch-sensitive points, a display device visible through the touch screen or the transparent regions thereof, the display device being operative to display to a user information regarding the function of individual touch-sensitive points of the touch screen wherein in a first mode individual characters are displayed adjacent to a respective touch-sensitive point, actuation of a touch-sensitive point by a user representing input of the corresponding single character, and in a second mode at least one image relating to a menu option or an operation to be performed is displayed adjacent a respective touch-sensitive point, actuation of a touch-sensitive point by a user representing selection of the corresponding option or operation.

15. A device according to Claim 14 wherein the display device is adapted in the second mode for input into a menu-driven system and to be switched to the first mode to allow a user to input textual or other alphanumeric data.

16. A device according to Claim 14 or Claim 15 wherein the display device is adapted for displaying information relating to medical patients.

17. A method of operating a display of information in which a device as claimed in any of claims 14 and 16 is used, the user of the device operating the display device thereof by actuating a respective touch-sensitive point of the touch screen to input a desired requirement from information displayed at the touch screen when the display device is in the first mode, and actuating a respective touch-sensitive point of the touch screen to select a menu option or operation displayed at the touch screen when the display device is in the second mode.

18. A hand held unit for acquisition, processing and onward transmission of data comprising a microprocessor, a memory, and input and output devices for receiving data into and displaying data in the memory wherein at least part of the memory is a data exchange module which is readily removable from the unit and which is connectable to remote apparatus operable to read and amend its contents.

19. A hand held unit according to Claim 18 which has a removable system memory module in which a program and/or data for controlling the unit is stored.

20. A hand held unit according to Claim 18 or Claim 19 wherein the input and output devices include a device as claimed in any of Claims 14 to 16.

21. A hand held unit according to any of Claims 18 to 20 further including a barcode reader and an electronic data link.

22. A data processing and acquisition system substantially as described herein with reference to the accompanying drawings.
23. A hand held unit for acquisition, processing and onward transmission of data substantially as described herein with reference to Figures 3A and 3B of the accompanying drawings.
24. A method of operating a display of information substantially as described herein with reference to the accompanying drawings.

**Patents Act 1977**Examiner's report to the Comptroller under Section 17 - 20 -  
**The Search report)**

<b>Relevant Technical Fields</b>		<b>Application number</b> GB 9412409.6
(i) UK Cl (Ed.M) G4A (AMP, AMX, ASX, AUXM)		<b>Search Examiner</b> B G WESTERN
(ii) Int Cl (Ed.5) G06F (12/00, 15/16, 15/21, 15/24, 15/42)		<b>Date of completion of Search</b> 3 AUGUST 1994
<b>Databases (see below)</b> (i) UK Patent Office collections of GB, EP, WO and US patent specifications.		<b>Documents considered relevant following a search in respect of Claims :-</b> 1-13, 22

**Categories of documents**

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2249851 A	(RONEY ET AL) See whole document	1-7, 10
X	US 4857713 A	(BROWN) See whole document	1-6, 10
X	US 4839806 A	(GOLDFISCHER ET AL) See whole document	1-4, 10
X	US 4415065 A	(SANDSTEDT) See whole document	1-4, 6, 10

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